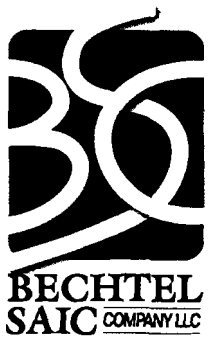

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Aging System Design Development Strategy

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Aging System Design Development Strategy

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Contents

Tables

1. Introduction and Background

This plan provides an overview, work to date, and the path forward for the design development strategy of the Aging cask for aging commercial spent nuclear fuel (CSNF) at the Yucca Mountain Project (YMP) repository site. Waste for subsurface emplacement at the repository includes U.S. Department of Energy (DOE) high-level radioactive waste (HLW), DOE SNF, commercial fuel in dual-purpose canisters (DPCs), uncanistered bare fuel, naval fuel, and other waste types. The following table lists the types of radioactive materials that may be aged at YMP, and those materials that will not be placed in an aging cask or module.

Table 1-1 Aging System Waste Types

Radioactive Waste Type	Candidate for Aging in a Site-Specific Cask or Module	Loaded Directly into Waste Packages and Emplaced Underground
Horizontal DPCs with CSNF	Yes	No[1]
Vertical DPCs with CSNF	Yes	No[1]
Uncanistered (bare) CSNF	Yes	Yes (if heat output is within established limits)
Naval SNF	No	Yes
Multi-Canister Overpacks (MCO)	No	Yes
DOE High-Level Waste	No	Yes
DOE Spent Nuclear Fuel	No	Yes

[1] DPCs are not currently certified for emplacement underground. They must be cut open and the SNF assemblies transferred to a waste package prior to subsurface emplacement.

This plan presents the strategy for design development of the Aging system. The Aging system will not handle naval fuel, DOE HLW, MCOs, or DOE SNF since those materials will be delivered to the repository in a state and sequence that allows them to be placed into waste packages for emplacement. Some CSNF from nuclear reactors, especially CSNF that is thermally too hot for emplacement underground, will need to be aged at the repository.

2. Overview of Process

The Aging system design development strategy will include design, fabrication, and placement into service of vertical aging casks and horizontal aging modules (HAM)s. The vertical casks, HAMs, and their transportation equipment will be similar to existing systems that are currently licensed under 10 CFR 72, *Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater than Class C Waste* (10 CFR 72 [DIRS 127267]) and in service at nuclear power plants around the nation. As with the existing storage systems, the Aging cask at YMP will be designed and fabricated by companies that have experience with dry storage of CSNF.

2.1 Specification Development

The current strategy for Aging system design development envisions using off-site vendors for the design of the vertical casks and HAMs. Qualified vendors who express an interest in providing either cask or HAM designs, or both, will be asked to submit a response to a Request for Proposal (RFP) to provide design services for the Aging cask and on-site transportation equipment.

The development of specifications for the Aging cask and transporters envisions two major initial activities. The first step is develop a performance specification(s) that is specific to the YMP site. This is a current activity and is discussed further in Section 3.3. The second is to examine existing cask systems licensed per 10 CFR 72 and evaluate their suitability for meeting the performance specification(s) unique to YMP. This is also a current activity and is discussed further in Section 3.4.

A vendor familiar with CSNF dry storage facilities will produce a design specification for the aging cask and cask transporters. The specification will consider the CSNF types from around the nation that will be accommodated by the system. The specifications will be based on calculations and analyses that are conducted specifically for YMP. Calculations and analyses will include the following specific issues:

- Structural
- Thermal
- Seismic
- Radiological
- Environmental and Meteorological

2.2 Licensing per 10 CFR 63

The Aging system design will be submitted to the U.S. Nuclear Regulatory Commission (NRC) as part of the *Yucca Mountain Repository License Application Safety Analysis Report* (DOE 2005 [DIRS 170675]). The aging portion of the license application and the accompanying Safety Analysis Report (SAR) will be based on conceptual design drawings and calculations. The license application will be produced by DOE subcontractor personnel and will be based on the requirements in 10 CFR 63, *Disposal of High-Level Radioactive Wastes in a Geologic Repository* (10 CFR 63 [DIRS 156605]). The license application will be produced to satisfy the acceptance criteria in the *Yucca Mountain Review Plan, Final Report* (NRC 2003 [DIRS 163274]).

The Aging system strategy will be to submit a design that is similar to what would be submitted under 10 CFR 72. The Aging system at YMP will use as guidance the *Standard Review Plan for Dry Cask Storage Systems* (NRC 1997 [DIRS 101903]). However, there may be some differences between 10 CFR 63 and 10 CFR 72 that require design modifications to existing cask systems. The licensing strategy for the Aging system casks is to use 10 CFR 72 as reference only for design criteria, and adapt the 10 CFR 72 designs, as needed, to assure compliance with 10 CFR 63. The strategy includes requesting dry storage cask vendors to evaluate current 10 CFR 72 criteria and determine whether the 10 CFR 63 criteria are satisfied by current licensed

designs. Differences between 10 CFR 63 and 10 CFR 72 will be noted and addressed as the evaluation of existing cask designs is moved forward.

2.3 Final Design

Final design of the Aging system components (aging casks, transfer equipment, foundations, alara concerns, etc.) is expected to commence during the licensing phase of YMP. After submittal of the SAR, the NRC is expected to take up to three years to review the documentation (see Section 8). The current YMP SAR information for the Aging system is based on a conceptual design. As the SAR is reviewed and preliminary design details are finalized, the final configuration of the Aging system can be further developed. The final design will incorporate changes that result from the NRC's review of the SAR.

2.4 Fabrication and Implementation

In the future, when licensing activities are completed, the Aging system components will be acquired. The vertical site-specific casks and HAMs, along with the transfer trailers and cask transporters, will be procured by DOE. The strategy will be to use, to the extent practicable, existing vendors and fabricators who are currently providing dry cask storage services to the nuclear power industry. Due to the variety of CSNF types that may be received at the repository, Aging system cask fabrication, delivery, and implementation will need to be coordinated with the waste stream being delivered to the repository. Matching the procurement of aging casks with the transportation schedule and delivery of CSNF from around the nation will require considerable lead time to assure that necessary Aging systems are available as needed. The strategy for implementation will require considerable flexibility for handling an incoming waste stream that contains a variety of materials with differing aging requirements.

3. Summary of Completed Activities

Design development of Aging structures, systems, and components (SSC)s is currently in the conceptual stage. Initial work to support the submittal of the SAR for geologic disposal of CSNF at YMP included compiling requirements and producing a conceptual design. The *SNF Aging System Description Document* (BSC 2004 [DIRS 171161]) contains the current set of design requirements and a conceptual design of the system. The conceptual design of the Aging system is nearing completion and will be followed by a preliminary design phase.

3.1 Conceptual Design Development

The project has completed a number of conceptual studies, calculations, and drawings that provide details of the Aging system that must be further developed. The current strategy for fiscal year 2005 is to advance the current conceptual design and further refine the *Yucca Mountain Repository License Application Safety Analysis Report* (DOE 2005 [DIRS 170765]). Table 3-1 summarizes the work accomplished by listing currently controlled Aging system calculations. The Aging strategy includes building upon and refining the work accomplished to date. The summary of calculations does not include thermal management reports or transportation analyses since those issues are handled by other departments. However, the Aging system design does consider those issues and the present design is flexible. The aging

conceptual design and strategy have been integrated with repository thermal management and transportation strategies to the extent practicable at this time.

Table 3-1 Summary of Controlled Aging System Calculations

Document Title	Document Identifier	Effective Date
Aging Facility Criticality Safety Calculations	170-00C-HA00-00100-000-00B	September 10, 2004
Design of a Concrete Slab for Storage of SNF and HLW casks	170-00C-HAP0-00100-000-00B	Pending (February 2005)
Shielding Evaluations for Spent Nuclear Fuel Aging Areas	170-00C-HAP0-00200-000-00A	May 10, 2004
Dose Rate Evaluations for Spent Nuclear Fuel Aging Areas	170-00C-HAP0-00400-000-00A	December 16, 2004
Midway Valley Aging Site Layout Drawing Support Calculation	170-C0C-C000-00100-000-00A	March 26, 2004

Project drawings of the Aging system have also been prepared to support the YMP SAR. Drawings include block flow diagrams, mechanical equipment envelopes, mechanical flow diagrams, site layout plans, and instrumentation diagrams that are available to support forward moving design development. These drawings are part of the conceptual design. Table 3-2 summarizes currently controlled Aging system drawings. These drawings represent the work completed through the first quarter of fiscal year 2005.

Table 3-2 Summary of Controlled Aging System Drawings

Aging System Drawing Title	Document Identifier	Approval Date
Geologic Repository Operations Area Aging Site Plan	170-C00-MGR0-00101-000-00A	March 26, 2004
Spent Nuclear Fuel Aging Area 1000 MTHM Aging Module Concrete Plan and Sections	170-DB0-HAP0-00101-000-00A	May 7, 2004
SNF Aging System Instrument Systems Functional Block Diagram	170-J00-HA00-00101-000-00A	April 26, 2004
SNF Aging System Block Flow Diagram Level 2	170-MH0-HA00-00101-000-00A	April 23, 2004
SNF Aging System Block Flow Diagram Level 3 (Sheet 1 of 2)	170-MH0-HA00-00201-000-00A	April 23, 2004
SNF Aging System Block Flow Diagram Level 3 (Sheet 2)	170-MH0-HA00-00202-000-00A	April 22, 2004
SNF Aging System Mechanical Flow Diagram (Sheet 1 of 3)	170-MH0-HA00-00301-000-00A	April 22, 2004
SNF Aging System Mechanical Flow Diagram (Sheet 2)	170-MH0-HA00-00302-000-00A	April 22, 2004
SNF Aging System Mechanical Flow Diagram (Sheet 3)	170-MH0-HA00-00303-000-00A	April 22, 2004
SNF Aging System Mobile Crane Mechanical Equipment Envelope	170-MJ0-HAP0-00101-000-00A	April 22, 2004

Aging System Drawing Title	Document Identifier	Approval Date
SNF Aging System NUHOMS MP187 Transport Cask Cart Mechanical Equipment Envelope	170-MQ0-HAT0-00101-000-00A	April 21, 2004
SNF Aging System NUHOMS MP197 Transport Cask Cart Mechanical Equipment Envelope	170-MQ0-HAT0-00201-000-00A	April 21, 2004
SNF Aging System Cask Tractor Mechanical Equipment Envelope	170-MQ0-HAT0-00301-000-00A	April 22, 2004
SNF Aging System MSC Transporter Mechanical Equipment Envelope	170-MQ0-HAT0-00401-000-00A	April 21, 2004
SNF Aging System HMSC Cart Mechanical Equipment Envelope	170-MQ0-HAT0-00501-000-00A	April 21, 2004
SNF Aging System Mobile Platform Mechanical Equipment Envelope	170-MX0-HAP0-00101-000-00A	April 21, 2004

3.2 Nuclear Safety Design Bases

The YMP has established a set of requirements to assure preclosure nuclear safety of the Aging system. As the Aging system design moves forward, satisfaction of the nuclear safety design bases will provide reasonable assurance that the performance objective of 10 CFR 63 (10 CFR 63 [DIRS 156605]) will be met. The design development strategy will progress with the specific intention to assure that the design bases from *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II) are satisfied. The proposed design bases for Aging system SSCs are summarized in Tables 3-3 through 3-9.

Table 3-3 Cask Tractor, HAM System - Nuclear Safety Design Bases

Aging Subsystem	Nuclear Safety Design Basis
Cask Tractor – HAM Subsystem	The cask tractor shall be designed to limit collision impact loads to values that assure waste container integrity.
	The cask tractor brake system shall be designed to prevent a cask tractor runaway event.
	The design of the horizontal cask transfer trailer/tractor shall limit the size, mass, maximum speed, and motive force to limit potential damage caused by collisions.
	Fires and explosions shall be precluded from initiating a cask tractor event sequence.
	Loss of power events shall be precluded from initiating a cask tractor event sequence.
	Tip-over during transfer shall be precluded by ensuring that minimum tip-over resistance/standards are maintained consistent with roadway design.
	The design of the horizontal cask transfer trailer tractor shall provide reliable means to stop and maintain stability.
	The cask tractor shall be designed for loading conditions associated with a Design Basis Ground Motion-2 level seismic event and demonstrate sufficient margin to a "no runaway" safety function for loading conditions associated with a Beyond Design Basis Ground Motion-level seismic event.

Table 3-4 Transfer Trailer, HAM System - Nuclear Safety Design Bases

Aging Subsystem	Nuclear Safety Design Basis
Transfer Trailer – HAM Subsystem	The design of the hydraulic ram shall ensure that it cannot fail or be operated in a manner that can cause DPC loss of function through excess force or ram over-travel.
	The horizontal cask transfer trailer shall be designed for loading conditions associated with a Design Basis Ground Motion-2 level seismic event and demonstrate sufficient margin to "no slapdown" and "no runaway" safety functions for loading conditions associated with a Beyond Design Basis Ground Motion-level seismic event.
	The design of the horizontal cask transfer trailer shall limit the maximum potential drop height.
	The design of the horizontal cask transfer trailer/tractor shall limit the size, mass, maximum speed, and motive force to limit potential damage caused by collisions.
	The design of the horizontal cask transfer trailer shall preclude tip-over during transfer by ensuring that the transfer equipment design precludes failure modes that could result in tip-over under design basis load handling conditions.
	The design of the horizontal cask transfer trailer shall preclude tip-over during transfer by ensuring minimum tip-over resistance/stability standards are maintained consistent with roadway design.
	Fires and explosions shall be precluded from initiating a HAM transfer trailer event sequence.

Table 3-5 Site-Specific Cask Transporter - Nuclear Safety Design Bases

Aging Subsystem	Nuclear Safety Design Basis
Site-Specific Cask Transporter	The site-specific cask transporter shall be designed for loading conditions associated with a Design Basis Ground Motion-2 level seismic event and demonstrate sufficient margin to "no slapdown" and "no runaway" safety functions for loading conditions associated with a Beyond Design Basis Ground Motion-level seismic event.
	A speed limit for the site-specific cask transporter shall be established such that a collision with shield or airlock doors or other heavy objects does not overturn the site-specific cask transporter or cause it to drop its load.
	The cask transporter shall prevent lifting the aging and transfer casks above their maximum handling height.
	The design of the site-specific cask transporter shall limit the maximum potential drop height.
	The design of the site-specific cask transporter shall limit the size, mass, maximum speed, and motive force to limit potential damage caused by collisions.
	The design of the site-specific cask transporter shall preclude tip-over during transfer by ensuring that the transfer equipment design precludes failure modes that could result in tip-over under design basis load handling conditions.
	The design of the site-specific cask transporter shall preclude tip-over during transfer by ensuring minimum tip-over resistance/stability standards are maintained consistent with roadway design.
	The design of the site-specific cask transporter shall provide reliable means to stop and maintain stability.
	Fires and explosions shall be precluded from initiating a site-specific cask transporter event sequence.
	Loss of power events shall be precluded from initiating a site-specific cask event sequence.
	Upon a loss of power, the transporter shall be designed to stop, retain the load, and enter a locked mode; upon a restoration of power, the transporter shall stay in the locked mode until operator action is taken.

Table 3-6 Site-Specific Transfer Cask - Nuclear Safety Design Bases

Aging Subsystem	Nuclear Safety Design Basis
Site-Specific Transfer Cask	The design of aging and transfer casks shall ensure that they can withstand a drop from the maximum handling height of a horizontal cask transfer trailer without loss of function.
	The design of the horizontal transportation and transfer casks shall ensure that they can withstand a drop of heavy objects handled during transfer operations; e.g., access cover plate, from the maximum handling height without adverse effects.
	Lightning strikes shall be precluded from initiating a site-specific transfer cask event sequence.

Table 3-7 Aging Pad - Nuclear Safety Design Bases

Aging Subsystem	Nuclear Safety Design Basis
Aging Pad	The design of the aging pad shall ensure that it is capable of performing functions that are important to safety during a maximum probable flood.
	The aging pad shall be located to avoid placement directly over surface or near-surface faults.
	The surface aging pad shall be designed for loading conditions associated with a Design Basis Ground Motion-2 level seismic event and demonstrate sufficient margin to a "no significant cracking/displacement" safety function for loading conditions associated with a Beyond Design Basis Ground Motion-level seismic event.
	To reduce the likelihood of a meteorite strike that could breach a cask, the exposed area on the aging pads shall not exceed 15 percent density of the pad area, with an associated aggregate exposed cross-sectional area less than 360,000 square feet, for the case involving 20,000 metric tons of heavy metal.
	The structure shall be designed for the loads associated with a precipitation intensity of 2.15 in./hr.
	Lightning strikes shall be precluded from initiating an aging pad event sequence.
	Surface facilities associated with the Aging system, where CSNF is handled or stored shall be designed to withstand the effects of a regional volcanic eruption without loss of capacity to perform their safety function.
	A barrier surrounding the aging pads shall ensure that the conditional probability of a skid-in impact and entry by aircraft from the side of the aging pad that would result in radiological consequences is 0.01 or less.

Table 3-8 Site-Specific Cask - Nuclear Safety Design Bases

Aging Subsystem	Nuclear Safety Design Basis
Site-Specific Cask	The site-specific casks and other vertical aging systems shall be designed for loading conditions associated with a Design Basis Ground Motion-2 level seismic event and demonstrate sufficient margin to "no tip-over" and "no breach" safety functions for loading conditions associated with a Beyond Design Basis Ground Motion-level seismic event.
	Tip-over or displacement of aging casks as a result of extreme wind or tornado events shall be precluded.
	Tip-over or displacement of aging casks as a result of differential pressure associated with a passing tornado shall be precluded.
	The design of aging casks shall ensure that they can withstand the differential pressure associated with a passing tornado without loss of function.
	Tip-over or displacement of aging casks as a result of being struck by a design basis tornado missile shall be precluded.
	The design of aging casks shall ensure that they can withstand being struck by a design basis tornado missile without loss of function.
	The design of aging casks shall ensure that they can withstand a drop from the maximum handling height of a site-specific transporter without loss of function.
	The design of aging casks shall ensure that they can withstand limited hydrogen explosions or fires involving batteries or limited quantities of fuel without loss of function.
	The design of the casks shall ensure acceptable thermal design performance during extreme temperature events based on YMP historical climate data.
	Short-duration vent blockage events involving site-specific casks shall be precluded from initiating an event sequence.
	Maximum snow, sand, or ash loads shall be precluded from initiating an event sequence involving site-specific casks.
	The design of the casks shall ensure that welded closure casks/canister confinement system designs preclude loss of confinement during life cycle operations and events following closure.
	The design of the site-specific cask shall ensure that bolted closure cask design protects seals from damage during life cycle operations and events following closure to maintain its primary confinement boundary function.
	Site-specific casks shall be designed to ensure nuclear criticality safety with optimum moderation and the most reactive waste forms despite any geometric rearrangements due to a drop or other handling incident.
	In case of a fire, the wall temperature of a loaded site-specific cask, being handled or at rest, shall not exceed its allowable operating range.
	In case of a fire, the wall temperature of a loaded site-specific cask with docking ring installed shall not exceed its allowable operating range.
	Lightning strikes shall be precluded from initiating a site-specific cask event sequence.

Table 3-9 Horizontal Aging Module - Nuclear Safety Design Bases

Aging Subsystem	Nuclear Safety Design Basis
Horizontal Aging Module	The HAM systems shall be designed for loading conditions associated with a Design Basis Ground Motion-2 level seismic event and demonstrate sufficient margin to a "no collapse" safety function for loading conditions associated with a Beyond Design Basis Ground Motion-level seismic event.
	Lightning strikes shall be precluded from initiating a HAM event sequence.
	Tip-over or displacement of HAMs as a result of extreme wind or tornado events shall be precluded.
	Tip-over or displacement of HAMs as a result of differential pressure associated with a passing tornado shall be precluded.
	The design of HAMs shall ensure that they can withstand the differential pressure associated with a passing tomado without loss of function.
	Tip-over or displacement of HAMs as a result of being struck by a design basis tornado missile shall be precluded.
	The design of HAMs shall ensure that they can withstand being struck by a design basis tornado missile without loss of function.
	The design of HAMs shall ensure that they can withstand limited hydrogen explosions or fires involving batteries or limited quantities of fuel without loss of function.
	The design of the HAMs shall ensure acceptable thermal design performance during extreme temperature events based on YMP historical climate data.
	Short-duration vent blockage events involving HAMs shall be precluded from initiating an event sequence.
	Maximum snow, sand, or ash loads shall be precluded from initiating an event sequence involving HAMs.
	The design of the HAMs shall ensure that welded closure casks/canister confinement system designs preclude loss of confinement during life cycle operations and events following closure.
	Fires and explosions shall be precluded from initiating a HAM event sequence.
	The HAMs shall be designed to withstand the effects of a regional volcanic eruption without loss of capacity to perform their safety function.
	The design of the horizontal DPC shall ensure that it has sufficient structural design margin to withstand maximum ram force events.

3.3 Recent Aging Strategy, Performance Specification

With the completion of the conceptual design for the YMP SAR (DOE 2005 [DIRS 170675], Section 1.2.7), the Aging design team has advanced the aging program by issuing a subcontract for the development of a technical performance specification for vertical site-specific casks, HAMs, and supporting site transport equipment. A subcontractor has been requested to prepare a technical performance specification for the design and fabrication of site-specific casks with matching cask transfer equipment (BSC 2004 [DIRS 172746]). The technical performance specification must be developed to meet the proposed nuclear safety design bases in Tables 3-3 through 3-9.

3.4 Recent Aging Strategy, Comparative Report

The current strategy for the aging cask design is to use currently developed CSNF dry storage systems modified, as required, to meet 10 CFR 63. The aging design team is currently in the process of requesting information from cask vendors to compare currently licensed designs and their performance criteria with the performance objectives for YMP. Performance objectives for YMP have been established in a scope of work document (BSC 2005 [DIRS 172747]), and the strategy entails evaluating current cask designs for compliance with YMP performance objectives and YMP site-specific hazards. This requires comparisons of current storage system designs to YMP site-specific requirements and analysis of the existing designs for compatibility with YMP criteria. Establishing the required design changes to currently licensed 10 CFR 72 systems for implementation at YMP is follow-on work.

4. Remaining Activities Leading to Implementation

Design development of the YMP site-specific Aging system activities have been grouped into seven principle areas or phases. The areas are listed below. The timeframe for these activities overlap. Licensing and regulatory support and interaction functions span nearly all phases. Design development of the Aging system is dependent on regulatory approval at various stages, though licensing is not directly considered a design function.

- Requirements and Specification Development (currently in-process)
- Conceptual Design, License Application, and Safety Analysis Report (currently in-process)
- Preliminary Design (Table 4-1)
- Final Design (Table 4-2)
- Licensing (Table 4-3) (currently in-process)
- Fabrication (Table 4-4)
- Implementation (Table 4-5)

The design development strategy for the remaining activities is dependent on schedule and scope advancement. The initial scope of Aging system design development and a preliminary schedule is outlined in the following sections. The activities and schedule will be more fully developed as the design advances and as project issues are resolved.

4.1 Preliminary Design

The preliminary design activities are summarized in the following tables and provide an outline of the path forward. The activities discussed previously in Section 3 and the documents listed in Tables 3-1 and 3-2 reflect the current conceptual design. The preliminary design will advance the conceptual design. The conceptual design is flexible, though the expectation is that the preliminary design will not differ significantly from the SAR conceptual design.

Table 4-1 Preliminary Design Activities

Preliminary Design (30 percent)	Activity	Activity Description	Time Frame
Preliminary Design	Package Contents	Establish preliminary calculations, drawings, reports, and specifications that comprise the YMP Aging system SSCs	FY 2006
	Establish Requirements	Finalize the requirements for the storage casks and other Aging SSCs. Identify appropriate codes and standards.	FY 2005
	Establish Interfaces	Specify interfaces between cask and surface repository facility systems.	FY 2006
	Evaluate Existing Storage Cask Systems	Summarize the existing horizontal and vertical storage systems that may be used at Yucca Mountain and establish which features will need evaluation to adapt the existing design to Yucca Mountain.	FY 2005
	Develop Design Inputs	Specify the inputs for the site-specific cask systems derived from the repository design, spent fuel configurations, and other considerations.	FY 2005
	Bounding Conditions	Establish bounding conditions for cask designs.	FY 2006
	Develop Storage Cask Designs	Complete design of horizontal and vertical systems to approximately 30 percent complete. Complete required structural, seismic, thermal, and radiological analyses.	FY 2006
	Develop Transfer System Designs	Complete design of horizontal and vertical transfer systems to approximately 30 percent complete. Complete required analyses.	FY 2006
	Reliability and Risks	Identify the risks associated with the preliminary design and any reliability issues.	FY 2006
	Perform Reviews	Conduct preliminary design reviews	FY 2006
	Identify any Needed Testing	Identify any unresolved issues that may need further testing or evaluation.	FY 2006

4.2 Final Design

Final design of the Aging system components will be based on the preliminary design that was submitted to the NRC as part of the YMP SAR. Final design will produce a suite of detailed drawings and specifications that will be used to procure the Aging system vertical casks, HAMs, and transfer equipment.

Table 4-2 Final Design Activities

Final Design (100 percent complete)	Activity	Activity Description	Time Frame
Final Design	Final Design Drawings	Complete set of drawings for vertical and horizontal cask system.	FY 2007 and FY 2008
	Establish Baseline and Implement Formal Change Control	Formally control the final design and ensure that changes are appropriately controlled, documented, and communicated.	FY 2008
	Verification of Design	Conduct formal verification of the horizontal and vertical designs. Verify implementation of the design inputs, requirements, and satisfaction of acceptance criteria.	FY 2008
	Approval of Package for Fabrication	Issue approval package for the storage and transfer systems.	FY 2008

4.3 Licensing

Licensing activities span all phases of the Aging system program. The SAR will be based on conceptual and preliminary design details. Submittal of the SAR to the NRC will be at the discretion of DOE. The state of the design at the time of the SAR submittal will be reflected in the SAR. As the design progresses, additional details will be provided to the NRC through amendments to the SAR. As the NRC reviews the SAR, the design development strategy recognizes that there will be requests for additional information. Those requests will be addressed during the final design phase of the Aging system.

Table 4-3 Licensing Activities

Licensing	Activity	Activity Description	Time Frame
Licensing	Prepare Preliminary Safety Analysis Report	Prepare, review, and finalize the aging section of the *Yucca Mountain Repository License Application Safety Analysis Report* (DOE 2005, [DIRS 170675])	FY 2005
	Submit Final Safety Analysis Report	Finalize SAR input for aging and submit to NRC via amendments to the SAR.	FY 2008
	Respond to Requests for Additional Information	Respond to NRC requests for additional information.	FY 2006 through FY 2008
	Receive License for Storage Cask Systems	Receive license for aging components needed to store CSNF in dry storage casks at YMP.	FY 2008

4.4 Fabrication and Implementation

Fabrication of the Aging SSCs and implementation at YMP is included in this design development strategy plan for completeness only. Fabrication and implementation are the culmination of the design development program.

Table 4-4 Fabrication Activities
(To be developed and expanded at a future time.)

Fabrication	Activity	Activity Description	Time Frame
Fabrication		Award Fabrication Contracts	FY 2008
		Fabricate Vertical Casks and HAMs	FY 2009
		Conduct Acceptance Testing	FY 2009
		Certify Storage Systems for Use	FY 2009
		Ship to Yucca Mountain	FY 2009
		Accept at Yucca Mountain	FY 2009

Table 4-5 Implementation Activities
(To be developed and expanded at a future Time.)

Implementation	Activity	Activity Description	Time Frame
Implementation		Load Casks and HAMs	FY 2010
		Transfer Casks and HAMs	FY 2010
		Monitor Casks and HAMs	FY 2010
		Return Aged CSNF to Handling Facility	Future
		Transfer Aged CSNF to Waste Package	Future

5. Conclusions

An Aging system at YMP is necessary to accomplish project goals for thermal management as discussed in *Thermal Management Study* (BSC 2005 [DIRS 172739], Section 7.3). The design development strategy of the Aging system envisions the utilization and implementation of SSCs that are very similar to currently licensed systems. A performance specification for the aging casks and a comparative report to evaluate existing casks against YMP specific criteria will be completed in the near-term. Existing designs that are currently in service at nuclear power plants will be analyze for suitability for use at YMP.

6. Acronyms

CFR	Code of Federal Regulations
CSNF	commercial spent nuclear fuel
DOE	U.S. Department of Energy
DPC	dual-purpose canister

FY	fiscal year
HAM	horizontal aging module
HLW	high-level radioactive waste
MCO	multi-canister overpack
NRC	U.S. Nuclear Regulatory Commission
RFP	request for proposal
SAR	Safety Analysis Report
SNF	spent nuclear fuel
SSC	structure, system, and component
YMP	Yucca Mountain Project

7. References

101903 NRC (U.S. Nuclear Regulatory Commission) 1997. *Standard Review Plan for Dry Cask Storage Systems*. NUREG-1536. Washington, D.C.: U.S. Nuclear Regulatory Commission. ACC: MOL.20010724.0307.

127267 10 CFR 72. Energy: Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater than Class C Waste. Readily available.

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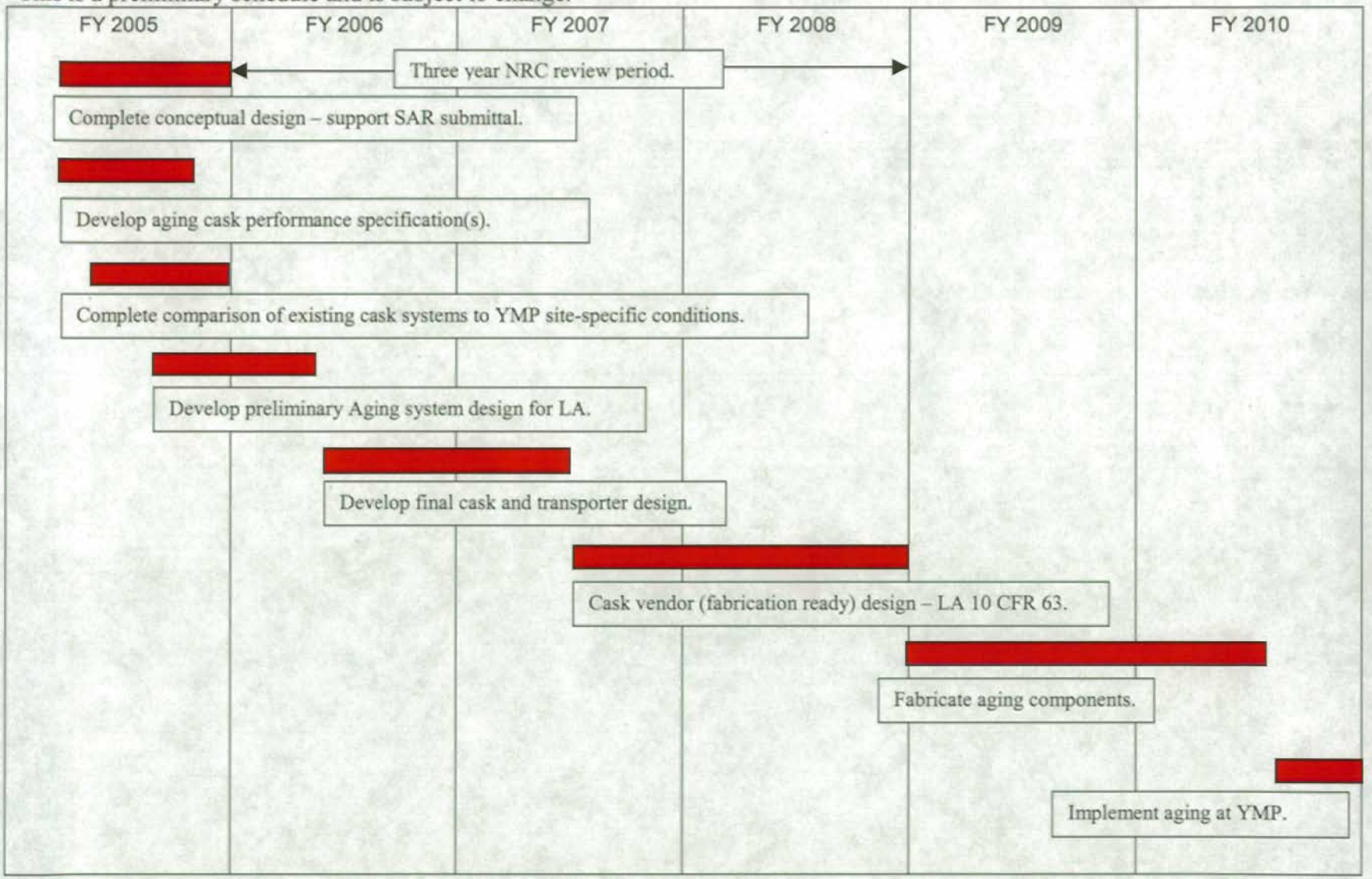
8. Aging System Design Development Schedule

This is a preliminary schedule and is subject to change.



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